

645.286	300 mm [12 Inches] Aluminum Pole	Each
645.289	Steel H-Beam Poles	kilograms [Pounds]
645.291	Roadside Guide Signs Type II	square meter [Square
	Foot]	
645.292	Regulatory, Warning, Confirmation and	square meter [Square
	Foot]	
	Route Marker Assembly Signs Type II	
645.301	Demountable Reflectorized Delineator, Single	Each
645.302	Demountable Reflectorized Delineator, Double	Each

SECTION 646 through 651 VACANT

SECTION 652 - MAINTENANCE OF TRAFFIC

652.1 Description This work shall consist of furnishing, installing, maintaining and removing traffic control devices necessary to provide reasonable protection for motorists, pedestrians and construction workers in accordance with these Specifications, the applicable provisions of Section 105.4.5 - Special Detours, and the plans.

Traffic control devices include signs, signals, lighting devices, markings, barricades, channelizing, and hand signaling devices, traffic officers, and flaggers.

652.2 Materials All traffic control devices shall conform to the requirements of Part VI of the latest edition of the MUTCD, and NCHRP 350 guidelines.

All signs shall be fabricated with high intensity retroreflective sheeting conforming to Section 719.01. All barricades, drums, and vertical panel markers shall be fabricated with high intensity orange and white retroreflective sheeting conforming to Section 719.01.

Construction signs shall be fabricated from materials that are flat, free from defects, retroreflectorized, and of sufficient strength to withstand deflections using a wind speed of 130 km/hr [80 miles/hr].

All barricades, cones, drums, and construction signs may be constructed from new or recycled plastic.

652.2.2 Signs Only signs with symbol messages conforming to the design of the Manual of Uniform Traffic Control Devices shall be used unless the Resident approves the substitution of word messages.

652.2.3 Flashing Arrow Board The flashing arrow board shall consist of at least 15 hooded amber sealed beam lamps arranged to present 4 horizontal messages; left arrow, right arrow, double arrow, and light bar only. In the three arrow signals, the second light from the arrow point shall not operate. The arrow shall be mounted on at least a 1200 mm by 2400 mm [4 ft by 8 ft] flat black board with the bottom of the sign approximately 2100 mm [7 ft] above ground.

Circuitry shall be solid state. The arrow board shall be equipped with a manual control and a solid state photocell control to reduce intensity a minimum of 50% when ambient light falls below 54 lx [5 foot candles].

Each flashing light shall use Lamp No. 4412 A, sealed beam par 46, 8800 candlepower with a flash rate of not less than 25 per minute, dwell time 50% per cycle.

Power for the flashing arrow board shall be from either a self-contained generator unit of sufficient power to operate the lamps at their rated output, or commercial power if available.

The flashing arrow board with generator and independent power drive shall be mounted on a pneumatic-tired trailer vehicle or other suitable support for hauling to various locations as directed.

652.2.4 Other Devices Vertical panel markers shall be orange and white striped, 200 mm wide by 600 mm high [8 in wide by 24 in high]. On the Interstate System, vertical panel markers shall be orange and white striped, 300 mm wide by 900 mm high [12 in wide by 36 in high].

Cones shall be orange in color, at least 710 mm [28 in] high, and retroreflectorized. Retroreflection shall be provided by a white band of retroreflective sheeting conforming to Section 719.01, 150 mm [6 in] wide, no more than 75 mm to 100 mm [3 in to 4 in]

from the top of the cone, and a 100 mm [4 in] wide white band at least 50 mm [2 in] below the 150 mm [6 in] band.

Drums shall be of plastic or other yielding material, and shall be approximately 900 mm [36 in] high and a minimum of 450 mm [18 in] in diameter. There shall be at least two retroreflectorized orange and at least two retroreflectorized white stripes at least 100 mm [4 in] wide on each drum. Metal drums shall not be used.

Warning lights and battery operated flashing and steady burn lights shall conform to the requirements Section 712.23 - Flashing Lights.

STOP/SLOW paddles shall be the primary and preferred hand-signaling device. Flags shall be limited to emergencies. The paddle shall have an octagonal shape and be at least 450 mm [18 in] wide with letters at least 150 mm [6 in] high and should be fabricated from light semi-rigid material.

Type I barricades shall be 600 mm minimum, 2400 mm maximum [2 ft minimum, 8 ft maximum] in length with a 200 mm [8 in] wide rail mounted 900 mm [3 ft] minimum above the ground. Type II barricades shall be 600 mm [2 ft] in length with two 200 mm [8 in] wide rails, and the top rail shall be mounted 900 mm [3 ft] minimum above the roadway. Type III barricades shall be 2400 mm [8 ft] in length with three 200 mm [8 in] wide rails, and the top rail shall be mounted 1500 mm [5 ft] minimum above the roadway.

The cross members of all barricades shall be of 13 mm [$\frac{1}{2}$ in] or 16 mm [$\frac{5}{8}$ in] thick plywood or other lightweight rigid material such as plastic, fiberglass or fiberwood as approved by the Resident. The predominant color for supports and other barricade components shall be white, except that unpainted galvanized metal or aluminum components may be used.

The portable message sign shall be a Winko-matic, or an approved equal. The sign message shall have a minimum of three lines and eight characters per line. It shall have a minimum clear visibility of 275 m [900 ft]. The changeability of the sign message shall be done with so-called, LED technology. The sign shall be lighted from above and below the message for night use. The sign shall be mounted on a heavy duty trailer. The trailer shall have leveling jacks and a 50 mm [2 in] ball hitch. The sign shall have capability of being raised to a minimum of 2 m [7 ft] above the trailer, measured for the bottom of the

sign. It shall be capable of being rotated 360° with respect to the trailer. The sign shall be solar powered. The controller shall be a high performance laptop computer with LCD display. It shall have a standard 72 Keyboard. The controller shall have the capability of a minimum 200 messages with a minimum 150 preprogrammed commonly used messages and 50 user created messages. It shall be enclosed in a weather proof cabinet on the trailer. The sign shall have the capability of flashing the message. There shall be a battery back-up power source in the event of failure.

CONSTRUCTION REQUIREMENTS

652.3.1 Responsibility of the Department The Department will provide Project traffic requirements such as allowable lane or road closures, minimum temporary lane widths, work zone speed limits, timing limitations, and allowable special detours and temporary structures. No revisions to these requirements will be permitted unless the Contractor can thoroughly demonstrate an overall benefit to the public and a Contract Modification is approved.

652.3.2 Responsibility of the Contractor The Contractor shall provide continuous and effective traffic control and management for the Project that is appropriate to the construction means, methods, and sequencing allowed by the Contract and selected by the Contractor.

652.3.3 Submittal of Traffic Control Plan The Contractor shall submit, at or before the Preconstruction Meeting, a Traffic Control Plan (TCP) that provides the following information to the Department:

- a. The name, telephone number, and other contact numbers (cellular phone, pager, if any) of the Contractor's employee (the "Responsible Person") with overall responsibility for following the TCP, and who is empowered to immediately resolve any traffic control deficiencies or issues.
- b. Proposed construction phasing or sequencing that reasonably minimizes traffic impacts. The Contractor shall conduct the Work such that traffic delays do not exceed 5 minutes unless longer periods are authorized by the Department. The Contractor shall provide advance signing to warn motorists of expected traffic backups or queues.
- c. A written narrative and/or plan explaining how traffic and pedestrians will be

moved through the Project Limits, including transitions during the change from one phase of construction to the next, as applicable.

d. Temporary traffic control treatments at all intersections with roads, rail crossings, businesses, parking lots, pedestrian ways, bike paths, trails, residences, garages, farms, and other access points, as applicable.

e. A list of all certified flaggers to be used on the Project, together with the number of flaggers which will be used for each type of operation that flagging is needed. If the Contractor is using a flagging Subcontractor, then the name and address of the Subcontractor may be provided instead of a list of flaggers.

f. A procedure for notifying the Resident, local emergency officials, and local government officials (including the name and phone numbers of such officials) whenever significant traffic impacts are anticipated or occur. For a related provision, see Section 105.2.2 - Project Specific Emergency Planning.

g. A description of any special detours including provisions for constructing, maintaining, signing, and removing the detour or detours, including all temporary bridges and accessory features and complete restoration of the impacted land.

h. The maximum length of requested contiguous lane closure. The Contractor shall not close excessive lengths of traffic lane to avoid moving traffic control devices.

i. The proposed temporary roadway surface conditions and treatments. The Contractor shall provide an adequate roadway surface at all times; taking into account traffic speed, volume, and duration.

j. The coordination of appropriate temporary items (drainage, concrete barriers, barrier end treatments, impact attenuators, and traffic signals) with the TCP.

The Department will review the TCP for completeness and conformity with Federal requirements, Contract provisions, the current edition of the MUTCD, and Department policy and procedures. No review or comment by the Department, or any failure to review or comment, shall operate to absolve the contractor of its responsibility to design and implement the plan in accordance with the Contract, or to shift any responsibility to the Department. If the TCP is determined by the Department to be operationally

ineffective, the Contractor shall submit modifications of the TCP to the Department for review, and shall implement these changes at no additional cost to the Contract. Nothing in this Section shall negate the Contractor's obligations set forth in Section 110 - Indemnification, Bonding, and Insurance.

652.3.4 General Prior to starting any work on any part of the project adjacent to or being used by the traveling public, the Contractor shall install the appropriate traffic control devices in accordance with the plans, specifications and the latest edition of Manual of Uniform Traffic Control Devices, Part VI. The Contractor shall continuously maintain the traffic control devices in their proper position, and they shall be kept clean, legible and in good repair throughout the duration of the work. If notified that the traffic control devices are not in place or not properly maintained, the Contractor may be ordered to immediately suspend work until all deficiencies are corrected.

No equipment or vehicles of the Contractor, their subcontractors, or employees engaged in work on this contract shall be parked or stopped on lanes carrying traffic, or on lanes or shoulders adjacent to lanes carrying traffic, at any time, except as required by ongoing work operations. Contractor equipment or vehicles shall never be used to stop, block, or channelize traffic.

The Contractor shall not store material or park equipment within 4.6 m [15 ft] of the edge of the established travel lanes. Equipment parked overnight between 4.6 and 9.1 m [15 and 30 ft] of the edge of the travel lane shall be placed behind positive barriers if feasible, or clearly marked by channelizing devices or other reflective devices.

Channelization devices shall include Vertical Panel Markers, Barricades, Cones, and Drums. These devices shall be installed and maintained at the spacing determined by the MUTCD through the work area.

Channelization devices consisting of barricades or drums, at a maximum spacing of 15 m [50 ft], shall be used in guardrail areas when neither the existing guardrail nor the new guardrail is in place. The Contractor shall not remove guardrail until absolutely necessary for construction operations in that area. The guardrail shall be replaced as soon as possible thereafter.

All excavation areas adjacent to the roadway shall be channelized continuously in both directions for the length of the project in all areas where the centerline strip is not

effective in accordance with the latest edition of the MUTCD.

Where the roadway is adjacent to an area being excavated, a minimum 600 mm [2 ft] shoulder should be maintained and the effective slope of the earth excavation beyond the 600 mm [2 ft] shoulder shall not be steeper than a 1½ horizontal to 1 vertical. The effective slope of rock excavation shall not be steeper than 1 horizontal to 1 vertical beyond the 600 mm [2 ft] shoulder. In the case of cuts over 1.5 m [5 ft] deep, an earth berm or other approved barrier shall be placed between the travel lane and the excavated area. In this instance, travel speeds shall be limited by specific advisory signing to 20 miles per hour in all cases. When excavation does not leave sufficient usable widths to maintain two-way traffic as provided in Section 105.4 - Maintenance of Work, one-lane traffic controlled by a traffic signal or continuous flagging may be considered. Closely spaced vertical panels, drums or other channelizing devices shall be used on any of these types of areas that are left exposed for short durations.

When paving operations or shoulder grading leave a 75 mm [3 in] or less exposed vertical face at the edge of the traveled way, channelization devices shall be placed 0.61 m [2 ft] outside the edge of the pavement at intervals not exceeding 183 m [600 ft] and a 1.2 m by 1.2 m [48 in by 48 in] W8-9 Low Shoulder sign shall be placed at a maximum spacing of 0.80 km [½ mile]. When paving operations or shoulder grading leave greater than a 75 mm [3 in] exposed vertical face at the edge of the traveled way, the Contractor shall place shoulder material for a width of at least 1.2 m [4 ft] to meet the pavement grade, and place channelizing devices as above, before the lane is opened to traffic.

Special Detours and temporary structures, if used, shall meet applicable AASHTO standards, including curve radii and grade.

652.3.5 Installation of Traffic Control Devices Signs shall be erected on temporary sign supports approved crashworthy devices in conformance with NCHRP 350 requirements so that the bottom of the sign is either 1) 300 mm [12 in] or 2) greater than 1.5 m [5 ft] above the traveled way. Post-mounted signs shall be erected so the bottom of the sign is no less than 1500 mm [5 ft] above the traveled way, and 2100 mm [7 ft] above the traveled way in business, commercial, and residential areas. Signs must be erected so that the sign face is in a true vertical position. All signs shall be placed so that they are not obstructed in any manner and immediately modified to ensure proper visibility if obstructed. Signs may be mounted lower or higher to fit the situation when authorized by the Resident. Cones shall be either weighted or nailed. Tires will not be allowed as

weights.

Vertical panel markers shall be mounted with the top at least 1200 mm [4 ft] above the traveled way.

Drums shall not be weighted on the top. Drain holes shall be provided to prevent water from accumulating in the drums. Drums may be weighted with up to 150 mm [6 in] of loose dry sand.

The Contractor shall operate and maintain the flashing arrow board unit and trailer and shall continuously supply fuel and lubrication for dependable service during the life of the contract. The units shall remain in continuous night and day service at locations designated until the Resident designates a new location or discontinuance of service.

The Contractor shall maintain the devices in proper position and clean them as necessary. Maintenance shall include the covering and uncovering of all signs when no longer applicable (even if for a very short duration). The sign shall be considered adequately covered when no part of the sign face is visible either around or through the covering.

The Contractor shall replace damaged traffic control devices with devices of acceptable quality, as directed by the Resident.

652.3.6 Traffic Control The Contractor shall provide a minimum roadway width of 6.7 m [22 ft] for two-way traffic and 3.4 m [11 ft] for one-way traffic. The existing travelway width shall be maintained to the maximum extent practical. Vertical panel markers, drums, cones, or striping shall be used to clearly delineate the roadway through the construction area. Two-way traffic operation shall be provided at all times that the Contractor is not working on the project. One-way traffic shall be controlled through work areas by flaggers, utilizing radios, field telephones, or other means of direct communication.

The traffic control devices shall be moved or removed as the work progresses to assure compatibility between the uses of the traffic control devices and the traffic flow. Traffic control devices that become unnecessary shall be immediately removed from use.

Pavement markings shall be altered as required to conform to the existing traffic flow

pattern. Repainting of pavement marking line, if required to maintain the effectiveness of the line, shall be considered maintenance of traffic control devices. No separate payment will be made. Inappropriate existing pavement markings shall be removed whenever traffic is rerouted, and temporary construction pavement markings shall be placed. Obliteration and removal of non-applicable markings and placement of temporary construction pavement markings shall be considered maintenance of traffic control devices and will be paid for under the appropriate Contract item. Traffic changes shall not be made unless there is sufficient time, equipment, materials, and personnel available to complete the change properly before the end of the workday. This provision will not be required when traffic is rerouted for brief periods during daylight hours and the route can be clearly defined by channelizing devices, or flaggers, or both.

652.4 Flaggers The Contractor shall furnish flaggers as required by the TCP or as otherwise specified by the Resident. All flaggers must have successfully completed a flagger test approved by the Department, and administered by a Department-approved Flagger-Certifier. All flaggers must carry an official certification card with them while flagging. Flaggers shall wear a vest, shirt, or jacket that is orange, yellow, yellow-green, or fluorescent versions of these colors, together with a hardhat with reflectivity. For nighttime conditions, similar outside garments shall be retroreflectorized, and shall be visible at a minimum distance of 300 m [1000 ft]. Lighted hand signal equipment shall be used, and the flagger station illuminated as needed, to assure visibility.

Flagger stations shall be located far enough in advance of the workspace so that approaching road users will have sufficient distance to stop before entering the workspace. While flagging, the flagger should stand either on the shoulder adjacent to the traffic being controlled, or in the closed lane. At a spot obstruction, the flagger may stand on the shoulder opposite the closed sections to operate effectively. Under no circumstances shall the flagger stand in the lane being used by moving traffic or have their back to oncoming traffic. The flagger should be clearly visible to approaching traffic at all times and should have a clear escape route.

When conditions do not allow for proper approach sight distance of a flagger or storage space for waiting vehicles, additional flaggers shall be used at the rear of the backlogged traffic or at a point where approaching vehicles have adequate stopping sight distance to the rear of the backlogged traffic. All flagger stations shall be signed, even when in close proximity. The signs shall be removed or covered when flagger operations are not in place, even if it is for a very short duration.

Flaggers shall be provided 10 minute breaks every two hours, and a lunch period away from the workstation. The Contractor shall furnish sufficient spare trained flaggers to provide continuous flagging during required or necessary breaks and during lunch periods.

652.41 Traffic Officers Traffic officers will be uniformed police officers.

652.5 Warning Lights Warning lights shall be installed at locations designated by the Resident before any work is done on the portions of roadway being used by traffic. Upon installation, all warning lights shall remain in continuous operation during the life of the project, unless otherwise authorized by the Resident.

When a suitable 120-volt AC power service source is available within 150 m [500 ft] of the designated warning light location, power operated flashing lights shall be installed. Two alternately flashing lamps shall be mounted approximately 600 mm [24 in] above the sign, spaced approximately 600 mm [24 in] apart.

When a suitable 120-volt AC power service source is not available, battery operated flashing lights may be erected. Four flashing lamps shall be mounted approximately 150 mm [6 in] above the sign, spaced approximately 300 mm [12 in] apart.

The power service connections shall be installed to the satisfaction of both the power company and the Resident. The Contractor shall make all necessary arrangements for the power service connections and be responsible for all charges incurred thereby, including power charges. The Contractor shall also be responsible for all outstanding bills from the electric power company for preliminary work done by the electric company for the power service connection.

When batteries are required for battery operated flashing lights, they shall be provided and replaced by the Contractor as necessary.

652.6 Night Work When work is scheduled during the hours of dusk or darkness, the Contractor shall provide and maintain lighting on all equipment and at all work stations.

The lighting facilities shall be capable of providing light of sufficient intensity (20 foot-candle, minimum) to permit good workmanship, safety and proper inspection at all

times. The lighting shall be cut off and arranged on stanchions at a height that will provide perimeter lighting for each piece of equipment and will not interfere with traffic, including commercial vehicles, approaching the work site from either direction.

The Contractor shall have available portable floodlights for special areas.

The Contractor shall utilize padding, shielding or other insulation of mechanical and electrical equipment, if necessary, to minimize noise, and shall provide sufficient fuel, spare lamps, generators, etc. to maintain lighting of the work site.

The Contractor shall submit a lighting plan at the Preconstruction Conference, showing the type and location of lights to be used for night work. The Resident may require modifications be made to the lighting set up in actual field conditions.

The Contractor shall furnish approved signs reading "Construction Vehicle - Keep Back" to be used on trucks hauling to the project when such signs are deemed necessary by the Resident. The signs shall be a minimum of 750 mm by 1500 mm [30 in by 60 in], Black and Orange, Type III FP-85. The older type "Construction Vehicle - Do Not Follow" signs may be used until the end of their service life.

All vehicles used on the project shall be equipped with amber flashing lights, visible from both front and rear, or by means of single, approved type, revolving, flashing or strobe lights mounted so as to be visible 360°. The vehicle flashing system shall be in continuous operation while the vehicle is on any part of the project.

Payment for lighting, vehicle mounted signs and other costs accrued because of night work will not be made directly but will be considered incidental to the related contract items.

652.7 Method of Measurement Signs and panel markers will be measured by the square meter [square foot] for all signs authorized and installed. Flashing arrow boards, portable-changeable message signs, and flashing and steady burn lights, will be measured by each unit authorized and installed on the project. Barricades, drums, and cones will be measured by each unit authorized. No additional payment will be made for devices that require replacement due to poor condition or inadequate retroreflectivity.

The accepted quantity of traffic officer and flagger time will be the number of hours the

designated station is occupied. The number of hours authorized for payment will be measured to the nearest $\frac{1}{4}$ hour.

Maintenance of traffic control devices will be measured by the calendar day or as one lump sum for all authorized and installed traffic control devices.

Warning lights will be measured by the group of lights furnished.

652.8 Basis of Payment The accepted quantity of signs and panel markers will be paid for at the contract unit price per square meter [square foot]. Such payment will be full compensation for furnishing and installing all signs, sign supports, and all incidentals necessary to complete the installation of the signs.

The accepted quantity of flashing arrow boards, portable-changeable message signs, barricades, battery operated flashing and steady burn lights, drums, and cones will be paid for at the contract unit price each for the actual number of devices authorized, furnished, and installed. Such payment shall be full compensation for all incidentals necessary to install and maintain the respective devices.

652.8.1 Maintenance of Traffic Control Devices

652.8.1.1 Payment by Calendar Day Maintenance of Traffic Control Devices will be paid for at the contract unit price per calendar day for each calendar day that the Contractor maintains traffic as specified herein. Such payment will be full compensation for moving devices as many times as necessary; for replacing devices damaged, lost, or stolen; and for cleaning, maintaining, and removing all devices used for traffic control, including replacing temporary pavement marking lines.

The contract unit price per calendar day for Maintenance of Traffic Control Devices shall be full payment each day for such maintenance, encompassing all areas of the contract, regardless of whether or not the work areas or projects are geographically separated.

652.8.1.2 Payment by Lump Sum Maintenance of Traffic Control Devices will be paid at the contract lump sum price. Such payment will be full compensation all days that the Contractor maintains traffic as specified herein, and for moving devices as many times as necessary; for replacing devices damaged, lost, or stolen; and for cleaning,

maintaining, and removing all devices used for traffic control, including replacing temporary pavement marking lines.

The contract lump sum price for Maintenance of Traffic Control Devices shall be full compensation for all days for such maintenance, encompassing all areas of the contract, regardless of whether or not the work areas or projects are geographically separated.

652.8.2 Other Items The accepted quantities of flagger hours will be paid for at the contract unit price per hour for each flagging station occupied, with no additional payment for overtime. The contract unit price shall be full compensation for hiring, transporting, equipping, supervising, and the payment of flaggers and all overhead and incidentals necessary to complete the work.

The accepted quantities of traffic officer hours will be paid for at the contract unit price per hour for each station occupied, with no additional payment for overtime. This price shall be full compensation for supplying uniformed officers with police cruisers, and all incidentals necessary to complete the work; including transportation, equipment, and supervision.

The accepted quantities of warning lights will be paid for at the contract unit price, per group, complete in place including the necessary power, and remaining in operation during active work of the project or as otherwise directed. Upon completion of the work, the lamps, fixtures, and the framework required to properly mount the lamps shall remain the property of the Contractor.

Payment for temporary pavement marking lines and pavement marking removal will be made under the respective pay item in Section 627 - Pavement Markings.

Payment for temporary traffic signals will be made under Section 643 - Traffic Signals.

There will be no payment made under the pay items in Section 652 - Maintenance of Traffic, for devices furnished or maintenance work required after the expiration of the adjusted total contract time.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
652.30 Flashing Arrow	Each
652.31 Type I Barricade	Each
652.311 Type II Barricade	Each
652.312 Type III Barricades	Each
652.32 Battery Operated Light	Each
652.33 Drum	Each
652.34 Cone	Each
652.35 Construction Signs	square meter [Square
Foot]	
652.36 Maintenance of Traffic Control Devices	Calendar Day
652.361 Maintenance of Traffic Control Devices	Lump Sum
652.37 Warning Lights	Group
652.38 Flaggers	Hour
652.381 Traffic Officers	Hour
652.41 Portable-Changeable Message Sign	Each

SECTION 653 - POLYSTYRENE PLASTIC INSULATION

653.01 Description This work shall consist of furnishing and installing a polystyrene plastic insulating layer at locations designated on the plans in accordance with these specifications.

653.02 General Insulating material shall be extruded polystyrene insulating board conforming to the requirements of AASHTO M230.

Pegs shall be hard wood, approximately 150 mm by 6 mm [6 in by ¼ in] round, pointed on one end.

653.03 Preparation of Foundation The insulating boards shall be placed on a compacted layer of granular material graded to a tolerance of 13 mm [½ in] above or below the required grade and cross section. The surface shall be free of rocks that would cause damage to the insulating boards. The type and thickness of the granular material will be as shown on the plans.